Search for Superjets at DØ

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On behalf of the DØ colloboration

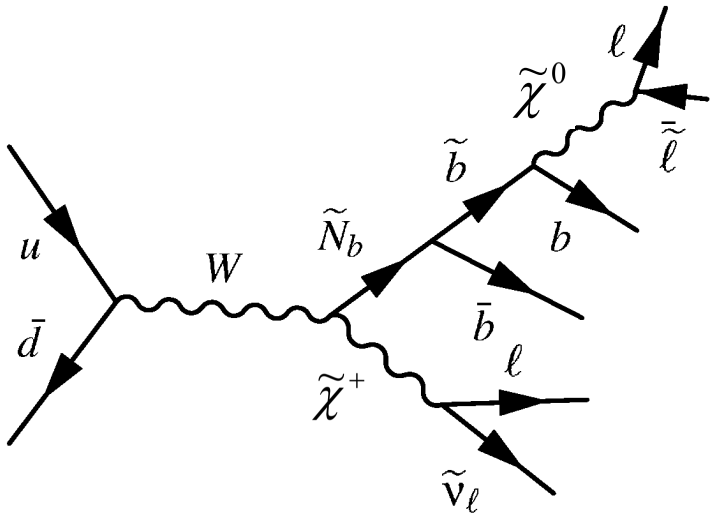
- Why search for new physics with superjets?
- Standard Model contributions to the W + superjet signal
- W + superjet event selection
- Checks on W selection: W transverse mass
- Results

Why study superjets?

Superjets are defined as jets with both secondary vertex and soft lepton tags

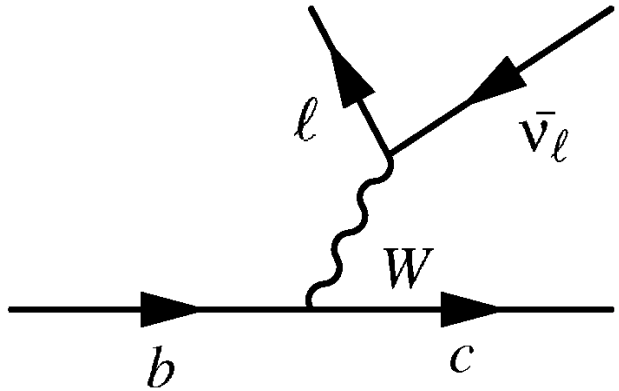
- Search for new physics within the top quark sample
- Require an inclusive W and b-tagged jets
- If observed, anomalies within this sample may suggest new physics

We're interested in the inclusive W sample: $W \rightarrow e\ \nu_e$ + jets

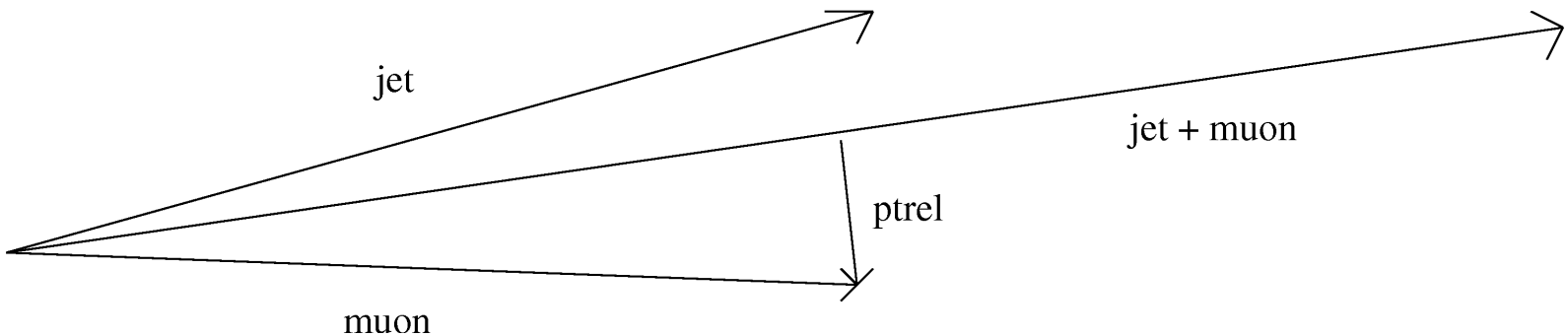


b-tagging

- Secondary vertex tagging
- Soft lepton tagging
  - soft lepton tagging uses a cut on lepton ptrel (shown below)
  - we conducted the superjet analysis both with and without a cut on ptrel > 1.0 GeV/c

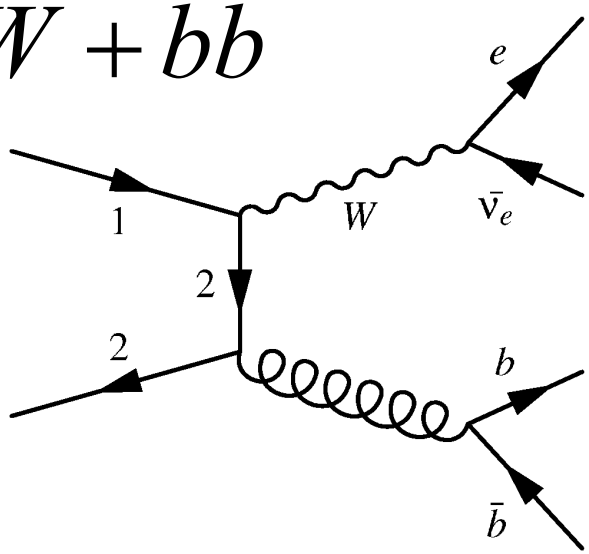


semileptonic b decay

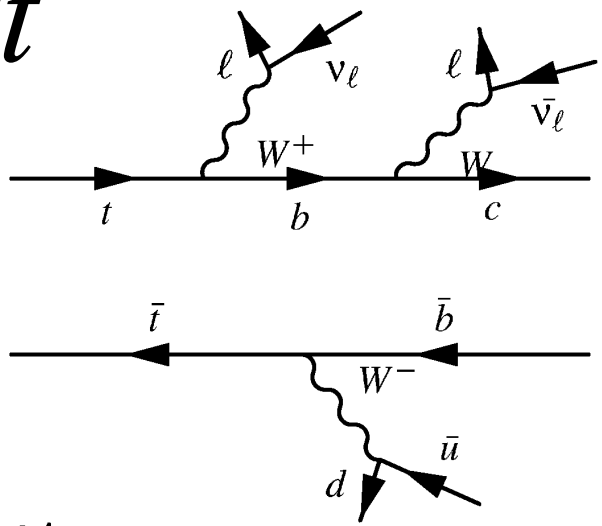


Standard Model contributions to superjet topology

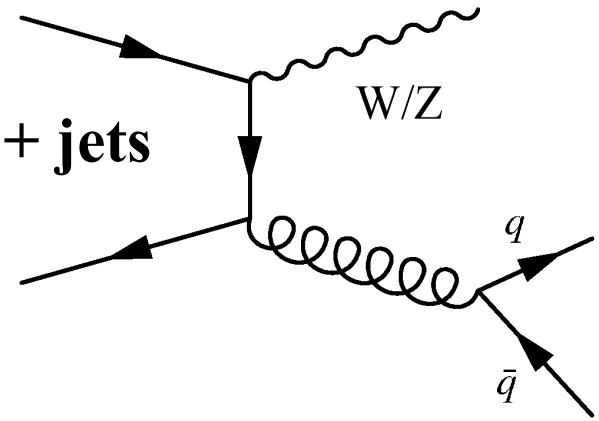
$W + b\bar{b}$



$t\bar{t}$



W/Z + jets



Event Selection

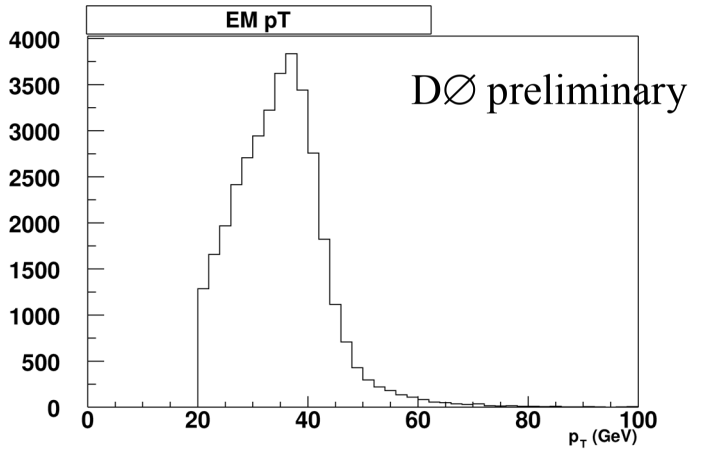
- $W \rightarrow e\ \nu_e$
  - certification cuts
  - $p_T > 20$ GeV/c, $|\eta_e| < 2.3$
  - MET > 25 GeV

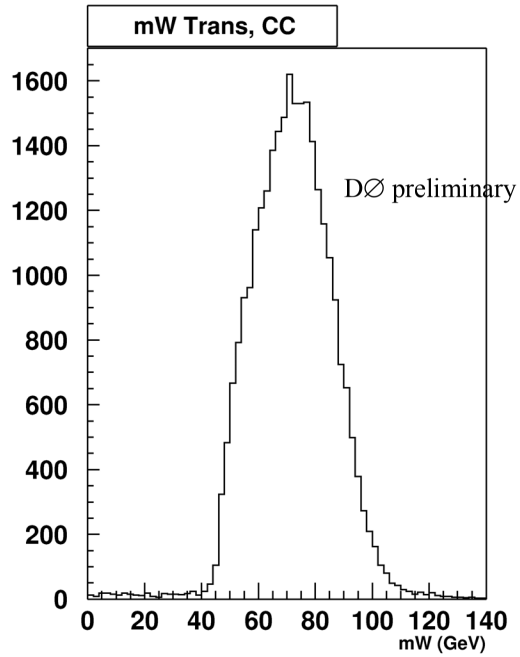
- Jets
  - certification cuts
  - $p_T > 25$ GeV/c, $|\eta_j| < 3.0$

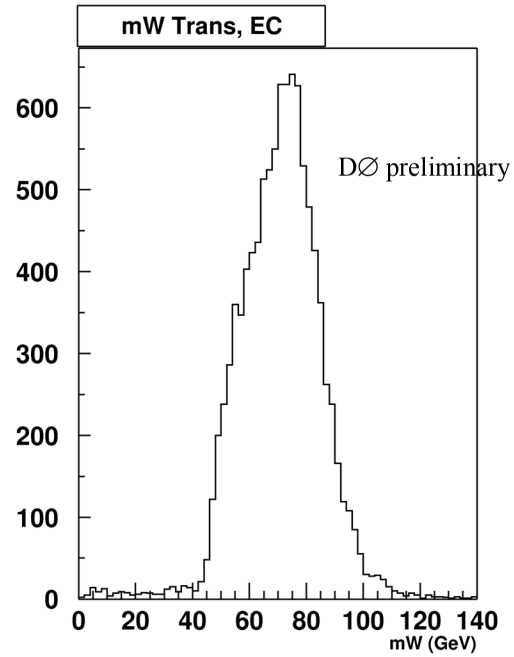
- Soft lepton (muon) tagging
  - ΔR(jet, muon) < 0.7
  - $p_T > 3.0$ GeV/c, $|\eta_\mu| < 2.0$
  - $p_\mu / E_{jet} < 0.5$
  - p_T of muon relative to jet (ptrel) > 1.0 GeV/c

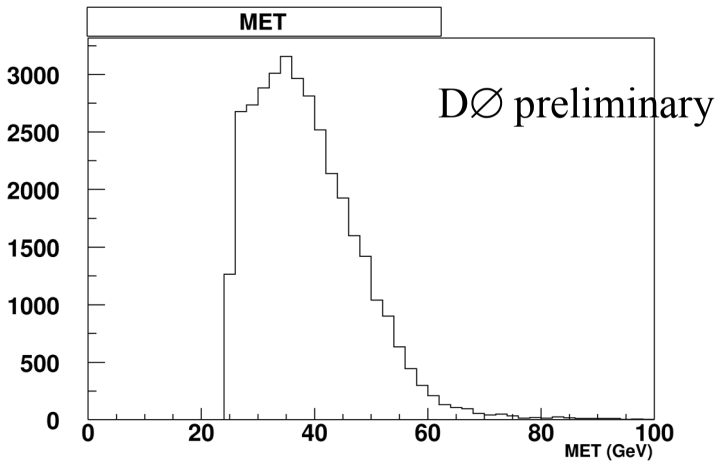
- Secondary vertex tagging
  - ΔR(jet, vertex-vertex vector) < 0.3
  - $L_{signif} = L_{xy} / \sigma_{xy} > 3.0$

Checks on W selection









all plots use new Run II data

Results: secondary vertex and soft lepton tagging

Secondary vertex tagging

DØ preliminary

	1 jet	2 jets	3 jets	4+ jets
Wbbbar	4.08 ± 0.24	1.44 ± 0.12	0.07 ± 0.03	0.01 ± 0.01
ttbar	0.07 ± 0.01	0.31 ± 0.03	0.61 ± 0.03	0.71 ± 0.03
W + jets	22.86 ± 3.22	9.41 ± 2.10	1.66 ± 0.54	0.37 ± 0.14
MC total	**31.91 ± 4.72**	**14.09 ± 3.29**	**2.50 ± 0.67**	**1.10 ± 0.19**
Data	**29**	**13**	**2**	**1**

Soft lepton tagging

DØ preliminary

	1 jet	2 jets	3 jets	4+ jets
Wbbbar	0.82 ± 0.14	0.45 ± 0.10	0.01 ± 0.01	0.01 ± 0.01
ttbar	0.04 ± 0.01	0.15 ± 0.03	0.29 ± 0.04	0.29 ± 0.04
W + jets	3.23 ± 1.46	2.21 ± 1.23	0.35 ± 0.19	0.03 ± 0.03
MC total	**7.21 ± 3.78**	**5.93 ± 3.38**	**0.66 ± 0.22**	**0.33 ± 0.08**
Data	**4**	**4**	**0**	**1**

expected number of events in 40.0 pb^{-1} of luminosity (Run II data).

Results: superjets

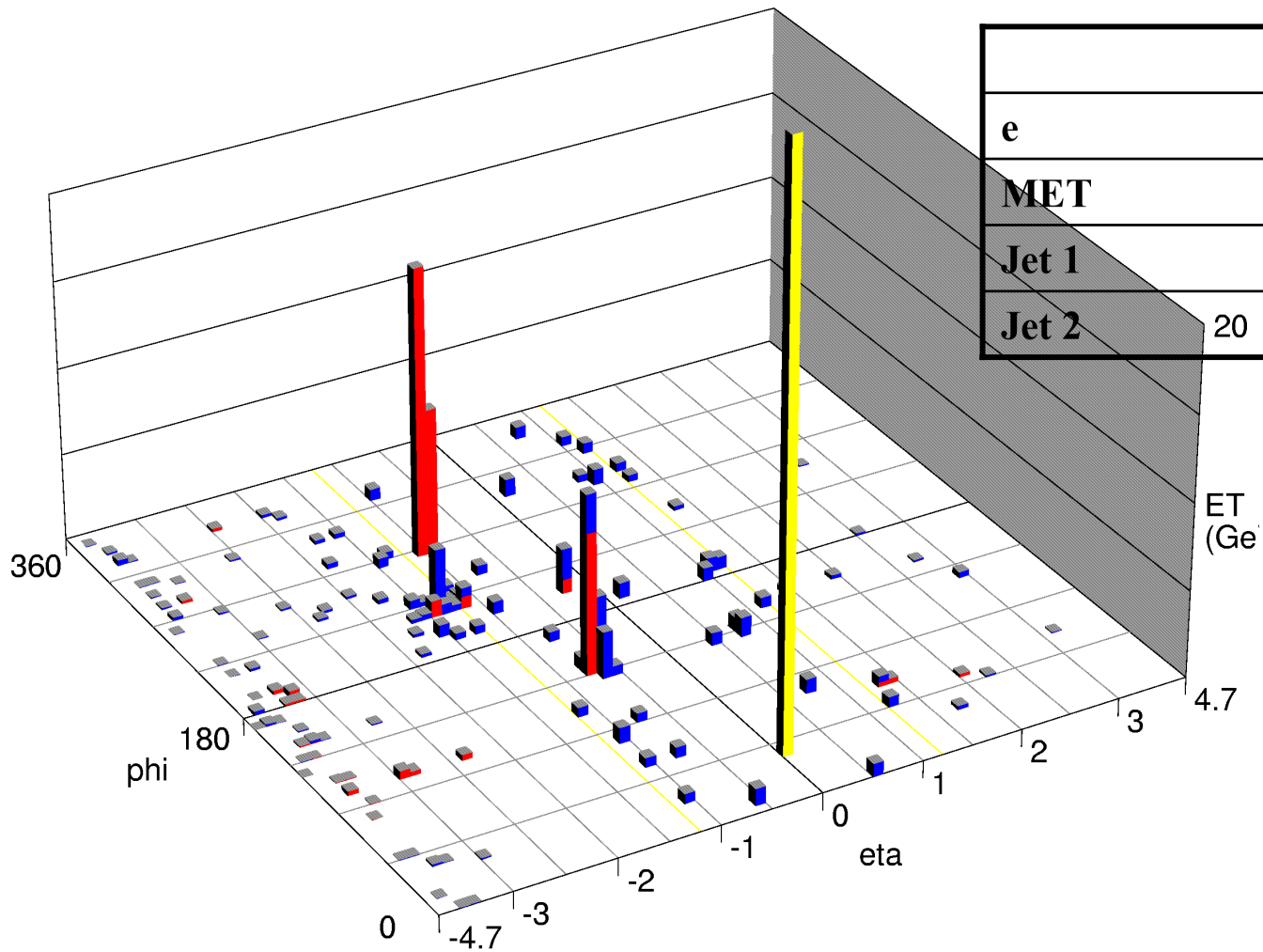
superjets (with ptrel cut) DØ preliminary

	1 jet	2 jets	3 jets	4+ jets
Wbbbar	0.42 ± 0.11	0.26 ± 0.08	0.01 ± 0.01	0.01 ± 0.01
ttbar	0.02 ± 0.01	0.09 ± 0.03	0.16 ± 0.03	0.18 ± 0.03
W + jets	1.73 ± 0.71	0.50 ± 0.16	0.00 ± 0.00	0.03 ± 0.05
MC total	**2.19 ± 0.67**	**0.87 ± 0.10**	**0.18 ± 0.13**	**0.21 ± 0.06**
Data	**0**	**0**	**0**	**0**

superjets (without ptrel cut) DØ preliminary

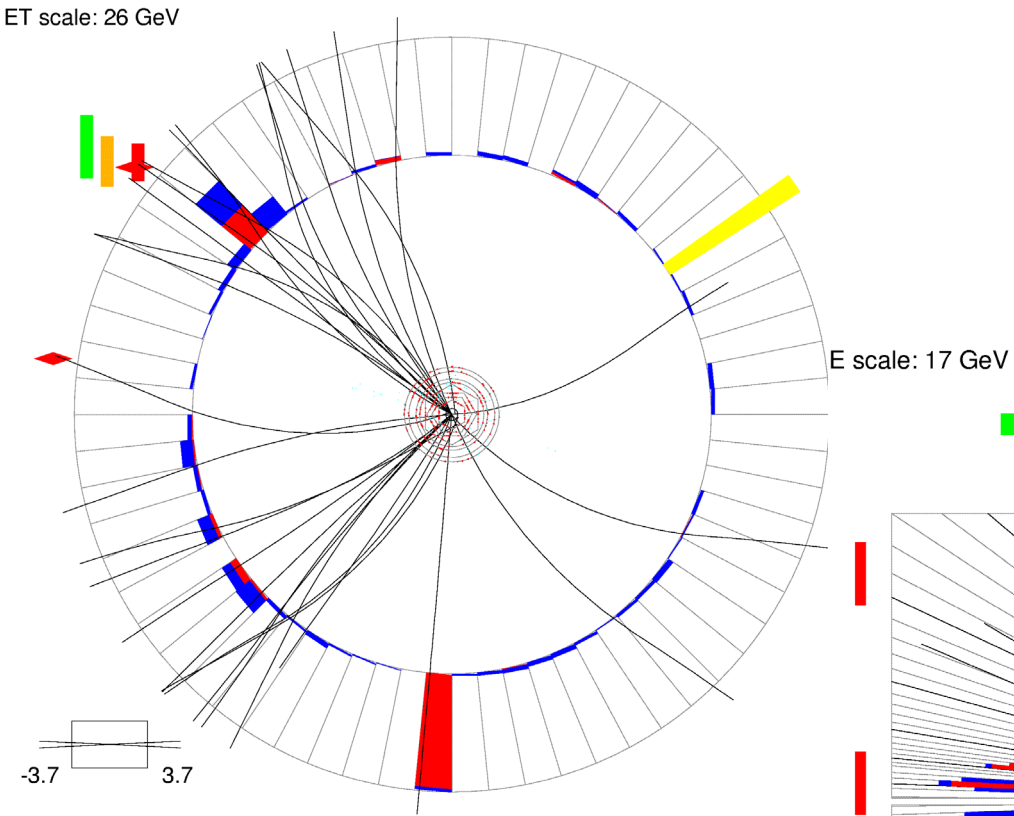
	1 jet	2 jets	3 jets	4+ jets
Wbbbar	0.58 ± 0.11	0.34 ± 0.09	0.01 ± 0.01	0.01 ± 0.01
ttbar	0.04 ± 0.01	0.13 ± 0.03	0.21 ± 0.03	0.25 ± 0.03
W + jets	1.73 ± 0.54	0.56 ± 0.27	0.00 ± 0.00	0.03 ± 0.03
MC total	**2.37 ± 0.59**	**1.06 ± 0.36**	**0.25 ± 0.04**	**0.27 ± 0.06**
Data	**0**	**1**	**0**	**1**

Event Views of Event 16256390, Run 168132: LegoPlot



	p_T
e	**32.27 Gev / c**
MET	**80.31 GeV**
Jet 1	**60.88 GeV / c**
Jet 2	**25.14 GeV / c**

Event Views of Event 16256390, Run 168132: XY and RZ views



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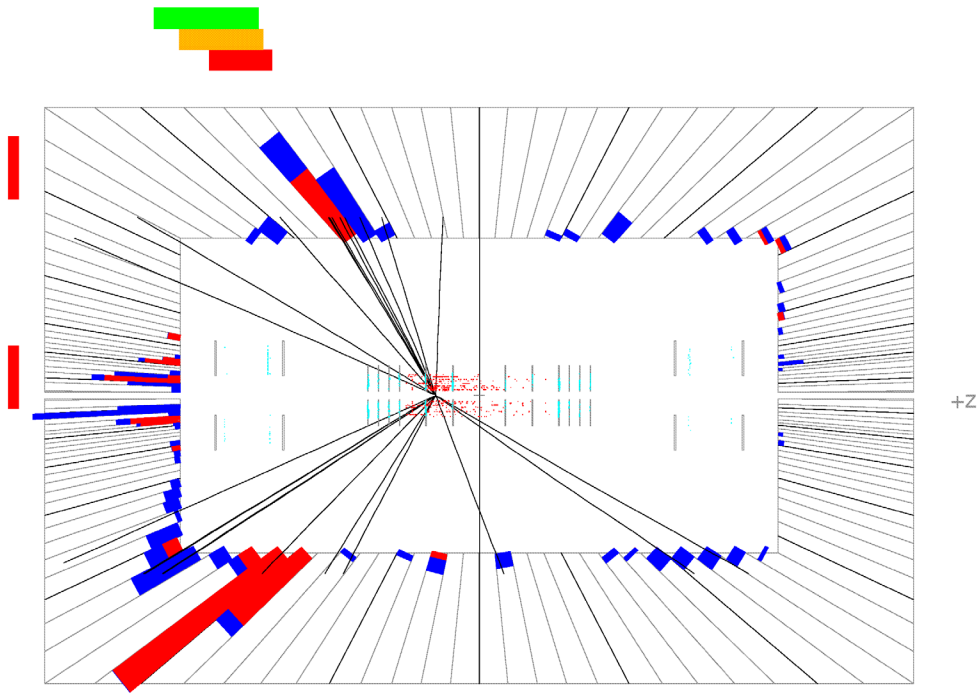

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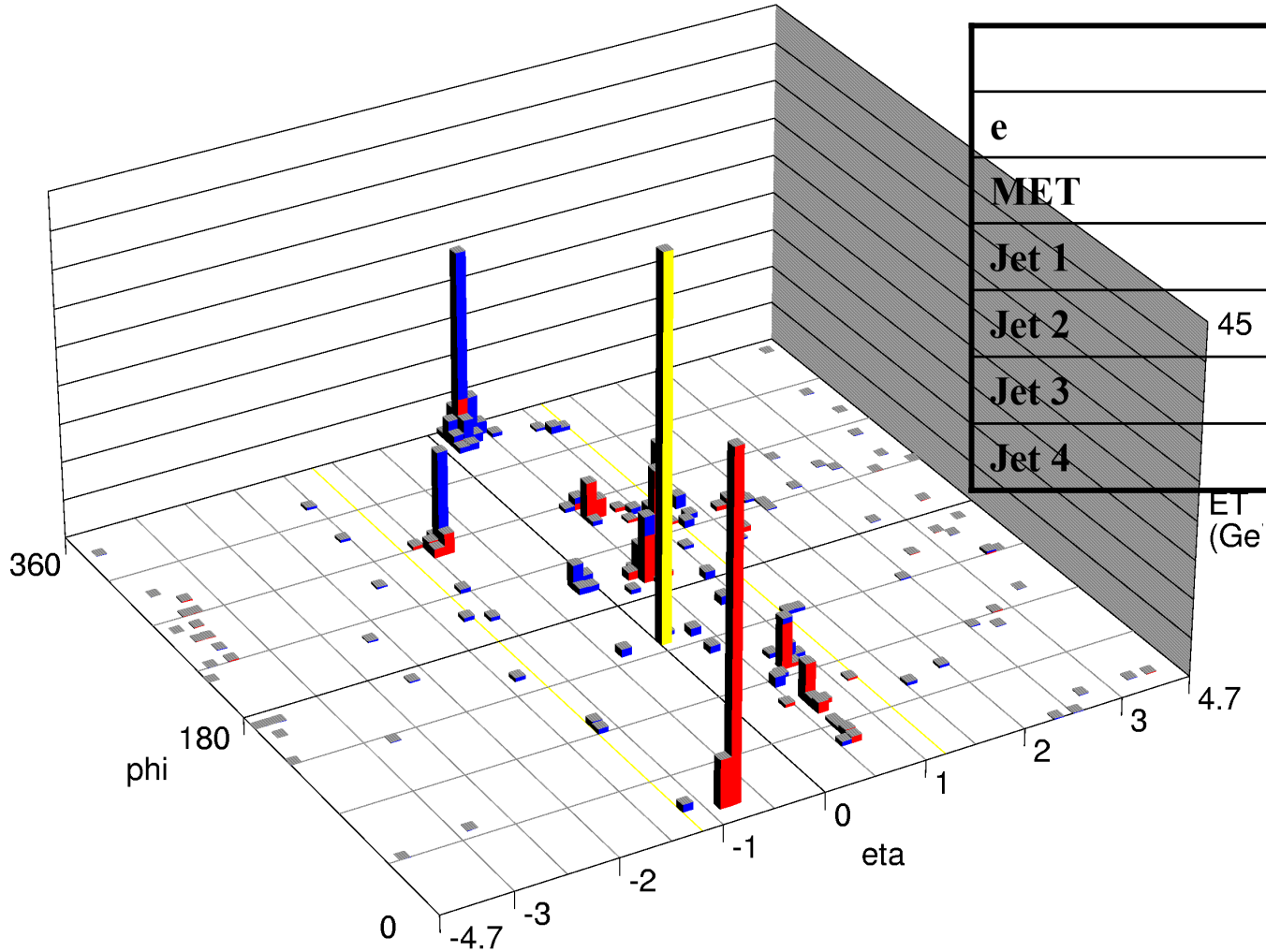
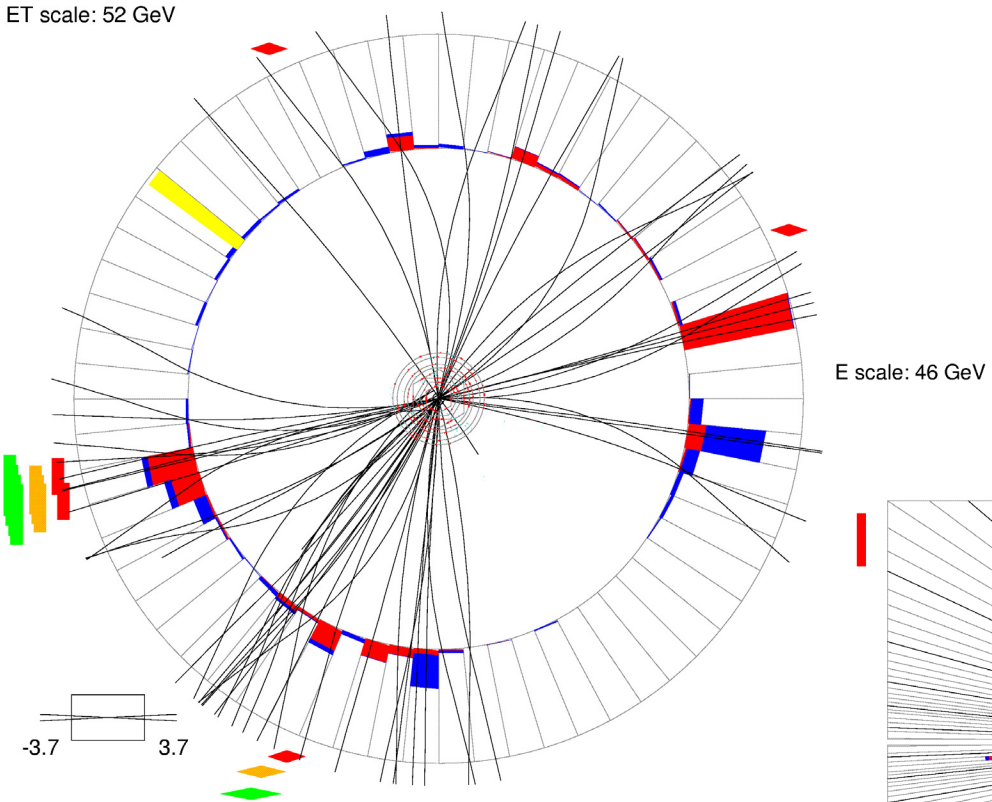
Event Views of Event 3591065, Run 168562: LegoPlot

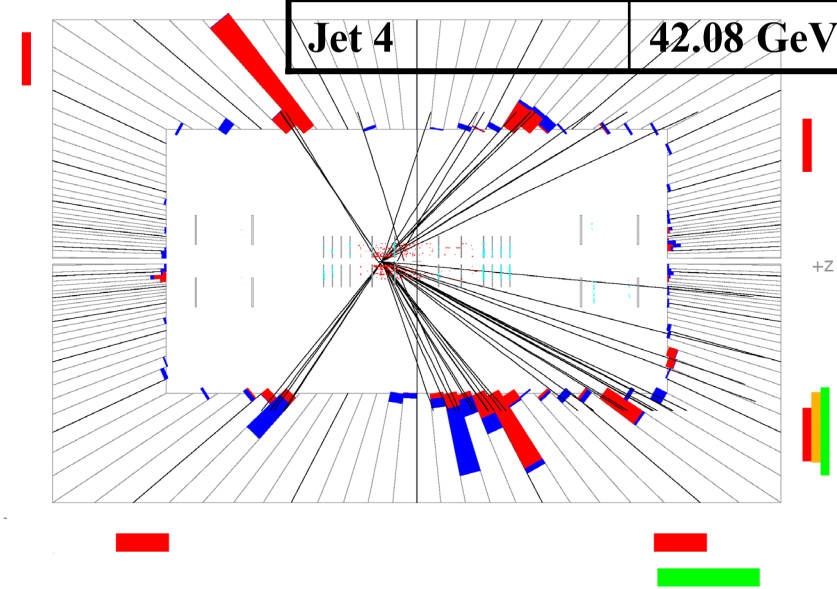


	p_T
e	60.07 GeV / c
MET	75.19 GeV
Jet 1	69.24 GeV / c
Jet 2	61.10 GeV / c
Jet 3	40.00 GeV / c
Jet 4	42.08 GeV / c

Event Views of Event 3591065, Run 168562: XY and RZ views



	p_T
e	60.07 GeV / c
MET	75.19 GeV
Jet 1	69.24 GeV / c
Jet 2	61.10 GeV / c
Jet 3	40.00 GeV / c
Jet 4	42.08 GeV / c



Summary

- Good agreement between expectations and data
- No suggestion of an anomaly, but more statistics and higher tagging efficiencies are needed to rule out new physics in this channel